

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### HEAVY USE AREA PROTECTION

(sq. ft.)

CODE 561

#### DEFINITION

Heavy Use Area Protection is used to stabilize a ground surface that is frequently and intensively used by people, animals, or vehicles.

#### PURPOSE

Heavy Use Area Protection is used:

- To provide a stable, non-eroding surface for areas frequently used by animals, people or vehicles
- To protect or improve water quality

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where a frequently or intensively used area requires treatment to address one or more resource concerns.

Heavy use area protection should only be planned when a change in management can't be used to address the identified resource concern.

#### CRITERIA

General Criteria for All Purposes

**Laws and Regulations.** Plan, design, and implement the practice to meet all federal, state, and local laws and regulations.

**Design Load.** Base the design load on the type and frequency of traffic, (vehicular, animal, or human) anticipated on the heavy use area.

**Foundation.** Evaluate the site foundation to ensure that the presumptive bearing capacity of the soil meets the intended design load and frequency of use.

Where necessary, prepare the foundation by removal and disposal of materials that are not adequate to support the design loads.

Use a base course of gravel, crushed stone, other suitable material, geotextile, or a combination of materials on all sites that need increased load bearing strength, drainage, separation of material and/or soil reinforcement.

On moderately to high shrink/swell soils with a linear extensibility of 3 or more, a minimum of a 4" layer of 3/8 inch crushed rock or concrete sand shall be used under concrete slabs or other non-flexible surfacing materials.

Refer to Natural Resources Conservation Service (NRCS), National Engineering Handbook, Part 642; Design Note 24, Guide for Use of Geotextiles; for geotextile selection.

If there is the potential for ground water contamination from the heavy use area, select another site or provide an impervious barrier. Make provisions to treat contaminated surface runoff from the impervious area.

**Surface Treatment.** Select a surface treatment that is stable and appropriate to the purpose of the heavy use area. All surface treatments should be planned and designed so that the top surface of the treatment is even with the natural ground surface outside the treatment area. The installation of the surface treatment should blend into the surrounding landscape without any abrupt changes in elevation or grade.

Surface treatments must meet the following requirements according to the material used.

Concrete. Design slabs-on-ground subject to distributed stationary loads, light vehicular

traffic, or infrequent use by heavy trucks or agricultural equipment in accordance with American Concrete Institute (ACI) *Guide for the Design and Construction of Concrete Parking Lots (ACI 330R)*.

Design slabs-on-ground subject to regular or frequent heavy truck or heavy agricultural equipment traffic in accordance with ACI *Guide to Design of Slabs-on-Ground (ACI 360R)*.

Design liquid-tight slabs in accordance with ACI *Code Requirements for Environmental Concrete Structures, Slabs-on-Soil (ACI 350, Appendix H)*.

Design concrete structures in accordance with NRCS National Engineering Manual (NEM), Part 536, *Structural Engineering*.

In lieu of a site-specific design for areas where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the slab thickness shall be a minimum of 4 inches.

The minimum compressive strength of the concrete mix shall be 3000 psi in 28 days.

Concrete reinforcement shall be one of the following; 10 gage 6 inch by 6 inch welded wire mesh, fiber reinforcement (FRC) or steel reinforcing bars whichever is appropriate to meet the design load.

Bituminous Concrete Pavement. Refer to AASHTO Guide for Design of Pavement Structures or the applicable State highway department's specification for design criteria for bituminous concrete paving.

In lieu of a site-specific design for areas that will be subject to light use, pave with a minimum of 4 inches of compacted bituminous concrete over a subgrade of at least 4 inches of well-compacted gravel. Use bituminous concrete mixtures commonly used for road paving in the area.

Other Cementitious Materials. Cementitious materials, such as caliches, soil cement, agricultural lime, roller-compacted concrete, and coal combustion by-products (flue gas desulphurization sludge and fly ash), can be used to provide a durable, stable surfacing material. Based on the properties of the surface material, develop a site-specific mix

design with compressive strengths necessary for the expected use and loading on the heavy use area. Select materials that are non-toxic and that have chemical properties that are compatible with the intended use.

Aggregate. Design aggregate surfaces for expected wear and intended use. In lieu of a site-specific design for areas that will be subject to light non-vehicular use, install a minimum combined thickness for aggregate surfacing material and a base course of 6 inches for livestock and 4 inches for other applications.

Use well graded aggregate consisting of sizes ranging from the maximum to the minimum specified so as to fill most of the voids. A well graded aggregate is a mixture of crushed stone that contains stone particles of a wide range of sizes and has a good representation of all sizes from the largest size specified, 3 inch or smaller, down to no more than 5 percent fines passing the No. 4 sieves (3/16 in.).

For all other applications, use Agricultural Engineering Note 4, *Earth and Aggregate Surfacing Design Guide*, or other appropriate methodology to design aggregate thickness.

Geotextiles are highly recommended on all aggregate surfacing installations. Geotextiles can enhance the performance of aggregate surfaces through stabilization of the subgrade. The geotextile fabric provides three important functions: separation, drainage, and reinforcement. The fabric serves as a permeable separation layer, preventing the aggregate and subgrade soils from intermixing while allowing the passage of water. Geotextiles should be planned and designed on all soils where the subgrade soils are classified as low strength or soils that are easily rutted. The Soil Suitabilities and Limitations for Use properties found in the Web Soil Survey can be used as a guide to estimate soil strength.

Mulches. Use a minimum layer thickness of 6 inches for materials such as limestone screenings, cinders, tanbark, bark mulch, brick chips, or shredded rubber. Mulches are not recommended for livestock or vehicular applications.

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**Vegetation.** Select vegetation that can withstand the intended use. Establish the vegetation in accordance with the criteria in NRCS CPS *Critical Area Planting (Code 342)* and Oklahoma Plant Materials Technical Note OK-21.

**Other.** Other materials can be used if they will serve the intended purpose and design life. Surfacing materials, such as crusher run gypsum rock, shall have a minimum layer thickness of 4 inches.

Crushed gypsum when mixed with manure and water can produce poisonous gas under the right circumstances. Crushed gypsum should not be used as a livestock heavy use surfacing material in non-ventilated areas or where runoff will enter a liquid waste retention structure.

**Structures.** Design any structures associated with the heavy use area according to the appropriate NRCS standards. When a roof is needed to address the resource concern, use NRCS CPS *Roofs and Covers (Code 367)*.

Where NRCS standards do not exist, such as non-waste applications, design structures according to the requirements of the particular construction material and accepted engineering practice.

**Drainage and Erosion Control.** Include provisions in the design for surface and subsurface drainage, as needed. Include provisions for disposal of runoff without causing erosion or water quality impairment. To the extent possible, prevent surface water from entering the heavy use area. All treatment areas shall be shaped to prevent ponding.

Stabilize all areas disturbed by construction as soon as possible after construction. Refer to the criteria in NRCS CPS *Critical Area Planting (Code 342)* and Oklahoma Plant Materials Technical Note OK-21 for establishment of vegetation. If vegetation is not appropriate for the site, use the criteria in NRCS CPS *Mulching (Code 484)* to stabilize the disturbed area.

#### **Additional Criteria for Livestock Heavy Use Areas**

The treated area can include all areas where livestock congregate and cause surface

stability problems. This includes stationary feeding areas, portable hay rings, watering facilities, feeding troughs, mineral boxes and other facilities where livestock concentrations cause a resource concern.

Provisions shall be made in planning, design, operation and maintenance to address, collect, store, utilize, or treat manure and contaminated runoff where contaminated runoff will cause a resource concern.

When the treated area will be used to confine animals for feeding, monitoring or any other reason, the Operation and Maintenance Plan is required to meet Comprehensive Nutrient Management Plan criteria for collection, storage, and utilization of the animal waste regardless of the number of animals or time confined.

**Feed and Watering Facility Apron.** Feed alleys and aprons around feed bunks and watering facilities need to be designed to withstand heavy traffic from livestock and farm equipment. Current research indicates that the protected area around facilities where livestock concentrations cause resource concerns is 12 feet wide or greater along feed bunks and around watering facilities. Designers may use less than 12 feet, based on local knowledge of soil conditions, herd size and management, or other operational measures. When applied, the minimum width shall be 8 feet and shall apply to all areas around the facility where livestock have access. Equipment width, as well as, drainage and snow accumulation should be taken into account when deciding the width of feed and watering facility aprons. When concrete is used, a rough broom finish surface provides better footing for livestock.

Aprons around feeding and watering facilities should be kept as small as possible. The typical feed or water trough space needed to accommodate large animals range from as little as 9 inches per animal weighing less than 600 pounds up to 30 inches for animals that weigh over 1,200 pounds. For additional guidance in the design of livestock facilities refer to Midwest Plan Services or other university publications.

**Confinement Areas and Lots.** The size of heavy use areas utilized by confined livestock is dependent on the landowner's operation

including type and number of animals, confinement periods, and/or the intended use. The size of treatment areas can range from 30 square feet per animal in partial-confinement to 400 square feet per animal in total confinement to 4000 or more square feet for animal exercise areas. Heavy use protection areas should be kept as small as practicable. For additional guidance in the design of livestock facilities refer to Midwest Plan Services handbooks or other university publications.

Use Oklahoma NRCS Conservation Practice Standards Critical Area Planting (342); Fencing (382); Prescribed Grazing (528); Filter Strip (393); Access Control (472) or other similar standards as companion practices, when needed to meet the intended purpose of the heavy use area protection.

#### **Animal Trails and Walkways Surfacing.**

Trails and walkways will be designed and constructed of sufficient size to accommodate the expected frequency of use and animal type(s) planned for the operation using the criteria found in Oklahoma Conservation Practice Standard 575 – Trails and Walkways.

For access ramps used to allow animal access to a fenced pond the rock used for surfacing shall be well graded 3 inch rock of adequate quality to withstand underwater conditions. The rock placed on the ramp shall be a minimum of 6 inches thick. A non-woven geotextile shall be installed under the rock. When needed for containment of rock, a Geocell containment system shall be used.

All other trail and walkways will require a site specific design based on the general criteria in this standard.

#### **Additional Criteria for Recreation Areas**

The Americans with Disabilities Act of 1990 (ADA) requires recreation areas that are used by the public to be accessible to people with disabilities. Address accessibility requirements for new construction and when existing facilities are being altered.

#### **CONSIDERATIONS**

Heavy use areas can have a significant impact on adjoining land uses. These impacts can be environmental, visual and cultural. Select a

treatment that is compatible with adjoining areas. Consider such things as proximity to neighbors and the land use where the stabilization will take place.

Vegetated heavy use areas may need additional materials such as geogrids or other reinforcing techniques or planned periods of rest and recovery to ensure that vegetative stabilization will succeed.

Consider the safety of the users during the design. Avoid slippery surfaces, sharp corners, or surfaces and structures that might entrap users. For heavy use areas used by livestock avoid the use of sharp aggregates that might injure livestock.

Paving or otherwise reducing the permeability of the heavily used area can reduce infiltration and increase surface runoff. Depending on the size of the heavy use area, this can have an impact on the water budget of the surrounding area. Consider the effects to ground and surface water.

Installation of heavy use area protection on muddy sites can improve animal health. Mud transmits bacterial and fungal diseases and provides a breeding ground for flies. Hoof suction makes it difficult for cattle to move around in muddy areas. In addition, mud negates the insulation value of hair coat and the animals must use more energy to keep warm. As temperatures fall, animal bunching may occur, which can reduce or eliminate vegetative cover and lead to erosion and water quality concerns.

To reduce the negative water quality impact of heavy use areas, consider locating them as far as possible from water bodies or water courses. In some cases, this may require relocating the heavily used area rather than just armoring an area that is already in use.

To the extent possible, maintain a 2 foot separation distance between the bottom of the surface material and the seasonal high water table or bedrock.

Surface erosion can be a problem on large heavy use areas that do not use a hard surface such as concrete. In these cases the designer may need to include measures on the area that reduce the flow length of runoff to reduce erosion problems.

To reduce the potential for air quality problems from particulate matter associated with a heavy use area, consider the use of NRCS CPS *Windbreak/Shelterbelt Establishment* (Code 380), *Herbaceous Wind Barriers* (Code 603), *Dust Control from Animal Activity on Open Lot Surfaces* (Code 375), or *Dust Control on Unpaved Roads and Surfaces* (Code 373) to control dust from heavy use areas.

Consider ways to reduce the size of the heavy use area as much as possible. This may require changes in how livestock are managed, but in the long run may result in less maintenance and a more efficient operation.

For areas that will need to be cleaned frequently by scraping, loose aggregate or other non-cementitious materials may not be the best choice. Consider a more durable surface such as concrete.

#### **PLANS AND SPECIFICATIONS**

Prepare plans and specifications for Heavy Use Area Protection that describe the requirements for installing the practice according to this standard.

As a minimum the plans and specifications shall include:

1. A plan view showing the location and extent of the practice. Include the location and distances to adjacent features and known utilities.
2. Typical section(s) showing the type and required thickness of paving or stabilization materials.
3. A grading plan, as needed.
4. Where appropriate, plans for required structural details.
5. Method and materials used to stabilize areas disturbed by construction.
6. Construction specifications with site specific installation requirements.

#### **OPERATION AND MAINTENANCE**

Prepare an operation and maintenance (O&M) plan and review with the operator prior to practice installation.

The minimum requirements to be addressed in the O&M plan are:

1. Periodic inspections – annually and immediately following significant rainfall events.
2. Prompt repair or replacement of damaged components especially surfaces that are subjected to wear or erosion.
3. For livestock heavy use areas, include requirements for the regular removal and management of manure, as needed.
4. For vegetated heavy use areas, restrict use as needed to protect the stand and to allow vegetative recovery.

#### **REFERENCES**

American Concrete Institute. 2006. Design of Slabs-on-Ground. ACI Standard 360R-06. Farmington Hills, MI.

Korcak, R. F. 1998. Agricultural Uses of Coal Combustion Byproducts. P. 103-119. *In* Wright, R. J., et al (eds.) *Agricultural Uses of Municipal, Animal and Industrial Byproducts*. USDA-ARS, Conservation Research Report 44.

USDA-Natural Resources Conservation Service. 2014. *Agricultural Engineering Note 4, Earth and Aggregate Surfacing Design Guide*, Washington, DC.

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